A GUIDE

TO THE

FOSSIL REMAINS OF MAN

IN THE DEPARTMENT OF

GEOLOGY AND PALÆONTOLOGY

IN THE

BRITISH MUSEUM (NATURAL HISTORY),

CROMWELL ROAD, LONDON, S.W.

WITH 4 PLATES AND 12 TEXT-FIGURES

LONDON
PRINTED BY ORDER OF THE TRUSTEES OF THE BRITISH MUSEUM
1915

PRICE FOURPENCE.

A GUIDE

TO THE

FOSSIL REMAINS OF MAN

IN THE DEPARTMENT OF

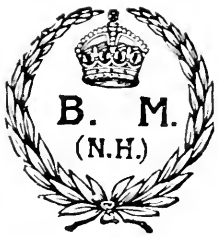
GEOLOGY AND PALÆONTOLOGY

IN THE

BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W.

WITH 4 PLATES AND 12 TEXT-FIGURES



LONDON
PRINTED BY ORDER OF THE TRUSTEES OF THE
BRITISH MUSEUM

1915

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W.

PREFACE.

Mr. Charles Dawson's discovery of the Piltdown skull has aroused so much interest in the study of fossil man, that this small Guide has been prepared to explain its significance. Most of the known specimens important for comparison are represented in the exhibited collection by plaster casts; and near these, in the same and adjacent cases, are arranged both human implements and associated animal remains to illustrate the circumstances under which early man lived in western Europe.

Thanks are due to the Council of the Geological Society for permission to reproduce Figs. 3 (A, B), 4, 5 (A, B, D), 7–8 (A, B, D), and 11, from the Society's Quarterly Journal.

A. SMITH WOODWARD.

Department of Geology,
December, 1914.

LIST OF ILLUSTRATIONS.

FOSSIL REMAINS OF MAN.

INTRODUCTION.

THERE can be no doubt, from a study of fossil skeletons, that at the remote geological period when back-boned animals first appeared as dwellers on the land, their blood was no warmer than the air around them. None of these animals, in fact, ranked higher in the scale of life than the cold-blooded reptiles of the present day; but they soon spread widely and became suited to every sphere of existence, not only occupying the various parts of the land itself, but also invading the air as flyers, and even returning to the sea as swimmers. They exhibited unparalleled diversity, many of them were of bizarre shape, and some attained a size which has never been equalled among land-animals in later times.

During the whole of the "Age of Reptiles," however, these different adaptations and remarkable growths occurred without any increase in the relative size of the brain. It was not until the appearance of warm-blooded quadrupeds, or mammals, towards the end of this age, that increase of brain-power became the essential factor of success in the struggle for existence. The day of mere bodily bulk and listless response to surroundings was now over; and the place of the reptiles was taken by animals in which the enlargement and increased efficiency of the brain were obviously of prime importance. As time passed, only those mammals survived and flourished, in which advances in the efficiency of the brain kept pace with increase in size or with special changes in the rest of their body. The lower races only continued to live when they were removed from stress of competition on such isolated lands as Australia, or when they were represented solely by small forms, which needed little food, and readily found safe shelter from their enemies.

There are several reasons for supposing that the earliest ancestors of all the mammals, with this remarkable tendency to enlargement and complication of the brain, were little tree-

RELATIVE LENGTHS OF EPOCHS AS REPRESENTED BY THICKNESS OF ROCKS.	CHARACTERISTIC HIGHEST ANIMAL LIFE.
	MAN.
TERTIARY. 1,600 ft.	Mammals with developing brain.
CRETACEOUS. 2,500 ft.	
JURASSIC. 5,000 ft.	Reptiles with insignificant brain, adapted for every sphere of life.
TRIASSIC. 3,000 ft.	
PERMIAN. 1,500 ft.	Reptiles with insignificant brain, gradually changing to overcome necessity for life in marshes.
CARBONIFEROUS. 12,000 ft.	Amphibians in marshes.
DEVONIAN. 4,000 ft.	Fishes.
SILURIAN. 7,000 ft.	
ORDOVICIAN. 15,000 ft.	
CAMBRIAN. 12,000 ft.	Water-animals without backbone.
PRECAMBRIAN. Extent unknown.	

Table of Geological Periods to show the relative shortness of the time during which the development of the brain in backboned animals has been of fundamental importance.

dwellers living in swampy forests. Most of their descendants left the forests and gradually became altered into such characteristic wanderers over the plains as horses, cattle, antelopes, deer and lions, in which the brain-growth was the accompaniment of many other changes in the body. Others remained in their original haunts, and the accession of brain-power was almost the only essential change that occurred in any of them. Now, the study of many kinds of fossils has shown that when, in successive generations, one part of the body begins to increase in size or complication much more rapidly than the other parts, this increase rarely stops until it becomes excessive. As a rule it passes the limit of utility, becomes a hindrance, and even contributes to the extermination of the races of animals in which it occurs. In the case of the brain, however, a tendency to overgrowth might become an advantage, and it seems reasonable to imagine that such an overgrowth in the early ape-like animals eventually led to the complete domination of the brain, which is the special characteristic of man. The little lemur-like animals of Eocene times would thus pass gradually into the larger apes of the Pliocene; and as soon as animals of this kind could feed and defend themselves by craft, their teeth and other primitive weapons might degenerate, as in man.

It has long been an aim of students of fossils to discover the links that are missing in this hypothetical chain connecting man with the early forest mammals, because, apart from adaptation to an upright gait, his skeleton is essentially identical with theirs. It would be interesting to trace the successive ancestors of the existing apes, with the slow improvement in their brain, the increasing power of their jaws and teeth, and the accession of strength to their arms. It would be still more interesting to follow the career of their "cousins," so to speak, in which the strengthening of the teeth and arms was ultimately checked and even diminished again by the rapid and excessive improvement of the brain. Monkeys, apes, and men, however, are remarkably wary in temperament, and they seem to have been always little liable to the accidents by which ordinary quadrupeds are destroyed, buried, and fossilised. Their remains are therefore very rare in the rocks, and their history in geological time is being but slowly revealed in a few scattered episodes or casual glimpses. These are illustrated in the Museum by a series of fossils and plaster copies of fossils, which it is the object of the present Guide-Book to explain.

LEMURS, MONKEYS, AND APES.

Remains of the early tree-dwelling forest mammals are found in the Eocene and Oligocene rocks both of Europe and of North America, so that they must have been widely distributed at least over the northern hemisphere at the beginning of the Tertiary period (or "Age of Mammals"). Well-preserved skulls of *Adapis* from the Phosphorites of France, and jaws of the same genus from

TABLE OF SUBDIVISIONS OF THE TERTIARY EPOCH OR AGE OF MAMMALS, corresponding with uppermost division in Table on p. 2.

NAMES OF SUBDIVISIONS (WITH MEANING).	CHARACTERISTIC MAMMALS.
Holocene (completely recent).	Dominated by Man.
Pleistocene (most recent).	Man and varieties of existing species of Mammals; few extinct species.
Pliocene (more recent).	Many existing genera of Mammals; no existing species.
Miocene (less recent).	Very numerous existing families of Mammals, including many adapted for life on plains; few existing genera.
Oligocene (little recent).	Beginning of numerous existing families of Mammals; no existing genera.
Eocene (dawn of recent).	Primitive Mammals, becoming subdivided into existing orders, chiefly adapted for life in marshes and forests.

the Hordwell Beds of the cliffs near Lymington, Hampshire, are especially noteworthy in the collection exhibited in Pier-case 3. Fragments of jaws of *Notharctus* and *Anaptomorphus* from the Eocene of Wyoming, U.S.A., may also be seen. Nearly complete skeletons of some of the American species are known, and there is no doubt that most if not all of these animals were essentially similar to the lemurs which still survive in the forests of southern

Africa and southern Asia, and are especially abundant in Madagascar. This great island, which has long been separated from the mainland, is at present the peculiar home—perhaps more correctly "refuge"—of the lemurs, where they flourish exceedingly. They are all small and most hide during the day, coming out only at night to feed on leaves and fruits, or sometimes on eggs and small animals; but just before man invaded Madagascar many of the lemurs attained a comparatively large size, and some may have been of aquatic habits. The skull of the extinct *Megaladapis insignis*, for example, represented by a model in Pier-case 3, measures not less than 15 inches in length, and the species of *Nesopithecus*, *Palæopropithecus*, and *Archæolemur*, represented by several well-preserved skulls, are also large. In fact, when a group of animals lives under favourable circumstances, and is placed beyond the reach of formidable enemies, its members always tend towards much variability and increase of size; only when adversity comes, the larger animals soon die out, while the smaller and less conspicuous alone survive.

The lemurs seem to have disappeared from the northern hemisphere at the end of Oligocene times, and were followed in the more southern parts, both of Europe and North America, by monkeys, which are animals of a distinctly higher grade in their brain-development.

In America monkeys spread as far south as Patagonia, but eventually became restricted to the forests of the tropical and sub-tropical regions, where they still survive in abundance. They are of a peculiar group, differing from all the Old World monkeys in the possession of three premolar teeth on each side instead of two, the flattening and widening of their nose, and the frequently prehensile nature of their tail. Since Miocene times, when they were represented in Patagonia by *Homunculus*, they appear to have lived unchanged, and they never produced great apes or made any approach to man. Skulls and jaws of *Mycetes* and *Cebus* are exhibited from the caverns of Brazil (Pier-case 3).

In the Old World the immediate predecessors of the monkeys seem to be represented by some small jaws and teeth of *Parapithecus* and *Propliopithecus* from a Lower Oligocene deposit in Egypt. As shown by plaster casts of these fossils in Pier-case 3 they are remarkable for the comparatively small size and weakness of the canine teeth. Typical modern monkeys, with the canine teeth enlarged into weapons, have lived since Miocene times. Portions of jaws and teeth of *Oreopithecus* from the Upper Miocene of

Tuscany, and various parts of the skeleton of *Mesopithecus* from the Lower Pliocene of Pikermi, near Athens, Greece, are exhibited. *Macacus* itself, which still survives on the rock of Gibraltar (the Barbary ape), seems to have had a wide range in Europe during the late Pliocene and early Pleistocene times, and a tooth of *Macacus pliocenus*, from the brick-earth of Grays, Essex, is shown in Pier-case 3.

All the Old World monkeys agree with man in having the same number of teeth (including only two premolars on each side), and all the existing species are also similar in having a comparatively narrow nose, with the nostrils opening downwards. None have prehensile tails, and many are tail-less. It is therefore very interesting to observe that since Middle Miocene times they have been accompanied by one family—that of the Simiidæ, or man-like apes—which approaches man very closely in many respects. It is represented at the present day by the gibbons and orangs of south-eastern Asia and the chimpanzees and gorillas of tropical Africa. In Miocene and early Pliocene times it also spread as far north as the middle of Europe; for jaws and teeth of a small gibbon, *Pliopithecus*, are known from the Middle Miocene, while jaws and teeth of a large ape, *Dryopithecus*, related to the chimpanzee and gorilla, occur in rocks between that age and the Lower Pliocene in France, northern Spain, Germany and Austria. A thigh-bone of a similar large ape has also been found in the Lower Pliocene of Eppelsheim, Germany. Plaster casts of the principal fossils of this kind are exhibited in Pier-case 3, and with them is a palate of *Palæopithecus*, a variety of chimpanzee, from the Lower Pliocene (Siwalik Formation) of the Punjaub, India.

The man-like apes are conspicuously inferior to man in the relative size of their brain, of which the bulk does not exceed 600 cubic centimetres, even in the largest known gorilla. They are also inferior in lacking certain features of the brain, which are intimately related to the special intellectual powers of man. Their head is not poised as in man on a backbone gently curved to make the upright gait comfortable and habitual; even in the gibbons, which regularly run on their hind limbs, the head is too heavy in front, and the backbone lacks the curve essential for long-sustained effort in the erect attitude. Their face is always relatively large, and provided with powerful weapons in the upper and lower canine teeth which completely interlock; while the sharp retreat of the bony chin, the arrangement of the front teeth, and the narrowness of the lower jaw, make real articulate speech impossible.

It may also be added that the existing apes have relatively large and powerful fore limbs or arms; but it is unlikely that the common ancestors of apes and man, when discovered, will show this preponderance of the fore quarters.

Pithecanthropus erectus.

The man-like apes seem to have disappeared from Europe early in Pliocene times, when the climate of this region began to assume a temperate character, and eventually passed through the glacial period. It is therefore necessary to search the geological formations of more tropical lands for the essential links between the ancestral apes and man. It seems unlikely that any of these animals would return to colder climes until they had acquired the faculty and habit of combating nature by the artificial means of clothing and fire—in fact, until they had actually become man.

Unfortunately, only one discovery which may perhaps be regarded as tending to fill the gap between the ancestral apes and man, has hitherto been made in the tropics; and the remains in this case are so fragmentary that they admit of more than one interpretation. They comprise the roof of a skull, two molar teeth, and a thigh-bone found by Professor E. Dubois in a river-deposit of either late Pliocene or early Pleistocene age at Trinil, in Java. They probably belong to a single individual, though this is uncertain, and they are considered by Dubois to represent a link between the gibbons and man, which he names *Pithecanthropus erectus*.

The roof of the skull is remarkably like that of the gibbons, which still live in Java, with a low crown and prominent brow-ridges; but it is relatively large, approaching the skull of a small man in size, with a brain-capacity apparently almost within the human limit, and some peculiarities which seem to be distinctly human. The two molar teeth, on the other hand, are more nearly like those of a gibbon than of a man. The thigh-bone implies an upright gait, but it is not completely human, the lower end especially being reminiscent of the gibbon. *Pithecanthropus* may, indeed, be an ancestral man, or it may be merely a gigantic and precocious gibbon. Like the extinct lemurs of Madagascar, some of the gibbons of Java may have been relatively gigantic just before the appearance of man.

Plaster casts of the roof of the skull and the two molar teeth of *Pithecanthropus* are exhibited in Table-case 1.

PILTDOWN MAN (*Eoanthropus dawsoni*).

True man, though of very low degree, had certainly reached Europe by the end of the Pliocene or beginning of the Pleistocene period. He had even spread so far as the southern part of England (then united with the continent), as proved by the discovery of portions of a remarkable skull and lower jaw in a river gravel at Piltdown, near Fletching, almost midway between Crowborough and Lewes in the Weald of Sussex. This discovery was made in 1912 by Mr. Charles Dawson, F.S.A., F.G.S., and the remains were presented to the Museum in 1913 by himself and the lord of the manor, Mr. G. M. Maryon-Wilson.

TABLE OF GEOLOGICAL AGES DURING WHICH MAN HAS LIVED IN WESTERN EUROPE,
corresponding with top black line in Table on p. 2.

	Ages named after nature of Implements.		Species of Man.
Holocene.	Historic.		
	Iron Age.		
	Bronze Age.		
	Neolithic (New Stone Age).		Modern Man.
Pleistocene.	Palæolithic (Old Stone Age).	Magdalenian.	
		Solutrean.	
		Aurignacian.	
		Mousterian.	Neanderthal Man.
		Acheulean.	?
		Chellean.	Heidelberg Man. Piltdown Man.
Pliocene.	Eolithic (Dawn Stone Age).		?

(For an account of the successive forms of stone implements see "A Guide to the Antiquities of the Stone Age in the Department of British and Mediæval Antiquities.")

The Piltdown gravel had attracted the attention of Mr. Dawson for some time, because he had noticed in it numerous peculiar flints from the chalk, which could not have been carried to the spot by any existing stream. The nearest watercourse is the River Ouse, which has cut a valley 80 feet deep since the gravel in question was deposited, and this river at present has no source in the chalk. The geography of the region has, in fact, completely changed, and the Piltdown gravel may have been left not even

by the Ouse, but by some river which has disappeared. It is therefore an unusually old gravel preserved by accident, and any fossil remains contained in it must naturally be of special interest.

Such remains were first found by workmen when digging the gravel for use on roads, and among them was the human skull which they broke up and threw away. One fragment was fortunately preserved and given to Mr. Dawson, who recognised its importance and at once began a search for the remainder of the specimen. Enough pieces were recovered to show the essential peculiarities of the skull. Part of the lower jaw and the lower canine tooth were eventually found in the adjacent undisturbed gravel, and both implements of human workmanship and fragmentary remains of animals were also met with.

As shown by the collection exhibited in Table-case 1, the animal remains are of two kinds. Cusps of a molar tooth of *Mastodon*, some broken pieces of a molar tooth of an early elephant (*Stegodon*), and some fragments of molar teeth of *Rhinoceros* are more highly mineralised than any mammalian teeth previously found in a superficial river-gravel, and closely resemble fossil teeth from the Pliocene Red Crag of Suffolk. They are indeed Pliocene fossils, but they are so much broken and worn that they must have reached the Piltdown gravel by being washed out of some older geological formation. Teeth of *Hippopotamus* and beaver (*Castor*) and the base of the antler of a red deer (*Cervus elaphus*) are less mineralised and more likely to be of the same age as the gravel itself. Though too imperfect for certain determination, these are probably early Pleistocene fossils.

The associated flints are also of two kinds. Many of the brown chipped pieces of tabular flint are identical in shape and style with the supposed primitive human implements, termed Eoliths, occurring in very old gravels on the North Downs near Ightham, Kent. They are often much waterworn, and may therefore, like the Pliocene teeth, have been derived from some older geological formation. The rare flints bearing obvious signs of human workmanship represent an extremely old type of Palæolithic implement, with one face produced by not more than one or two blows, the other face shaped by few coarse chippings (fig. 1). All these have sharp edges, not waterworn, and are therefore almost certainly of the same age as the gravel itself.

Hence the Piltdown gravel contains Pliocene mammalian remains and probably Pliocene flints which must have been derived from an older source, besides apparently Pleistocene

mammalian remains and early Palæolithic implements which are most likely of the same age as the gravel itself. As the human skull is scarcely waterworn, and as the portion of lower jaw and

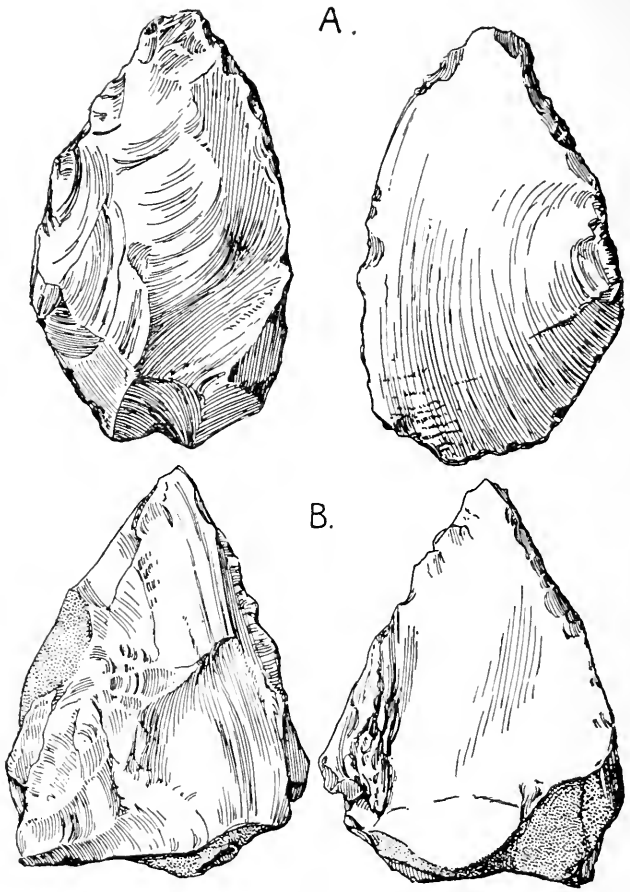
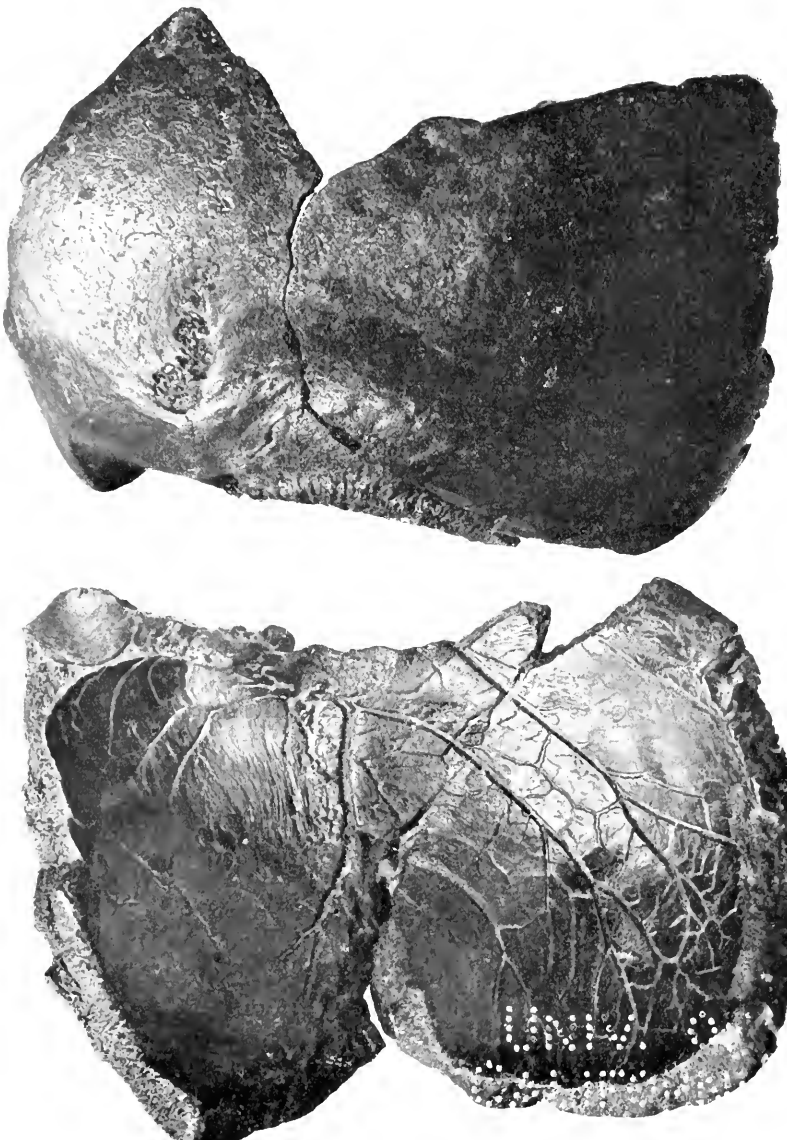
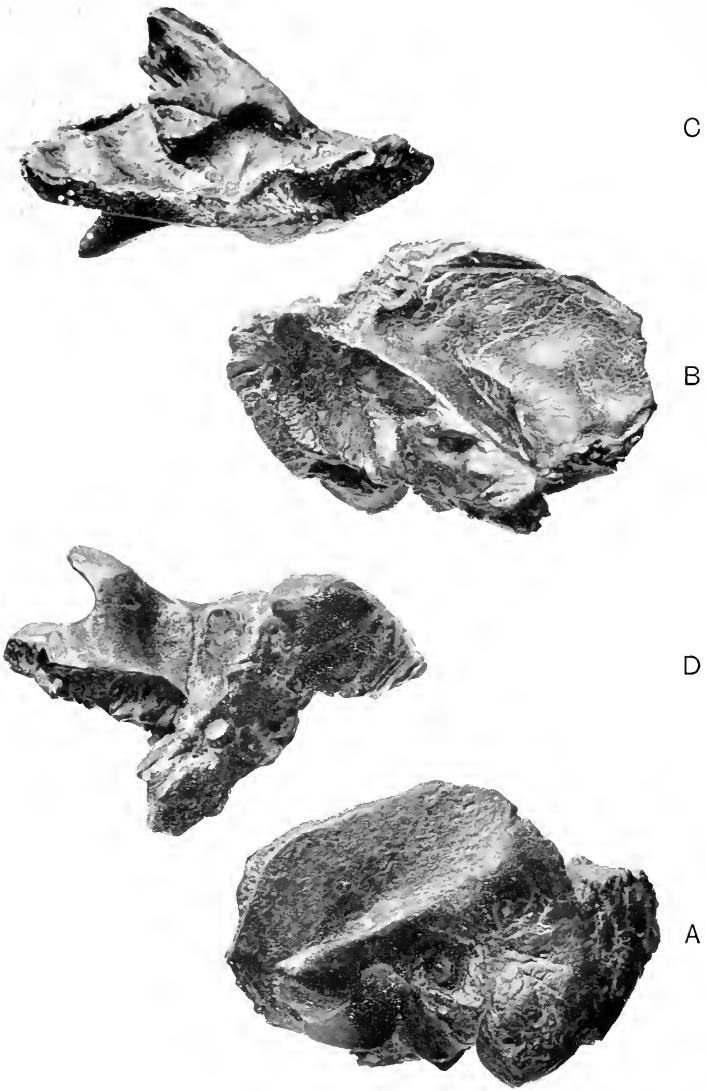


FIG. 1.—Two Palæolithic Flint Implements from Piltdown, each showing a coarsely flaked face and a simply flaked face, the second specimen (B) retaining portions of the outer crust of the nodule from which it was made; two-thirds nat. size.

the canine tooth were found close to it, these specimens are also probably of the same age as the gravel in which they occurred. So far as can be judged from present evidence, it is therefore



Photographs of outer (A) and inner (B) face of left fronto-parietal region of skull of Piltdown man, showing roof of orbit and absence of prominent brow-ridges; two-thirds nat. size.



Photographs of left temporal bone of skull of Piltdown man, outer (A), inner (B), upper (C), and lower (D) views; two-thirds nat. size.

reasonable to suppose that Piltdown man dates back to the beginning of the Pleistocene period.

All the human remains are well mineralised with oxide of iron, but they bear no signs of having been distorted or otherwise damaged during fossilisation. They also show no traces of disease. Of the brain-case there are four pieces, two uniting to represent the greater part of the left side (Plates I, II), the other two nearly uniting to show the hinder part of the right side and the back of the head (Plate III). Of the face, only the short nasal bones

FIG. 2.—Longitudinal median (sagittal) section of the Piltdown skull (black) superposed on that of a skull from the Lewes levels (dotted), showing the thickness of the bone and the lowness of the crown; nearly one-half nat. size. E = occipital protuberance of the Piltdown skull; H = occipital protuberance of the Lewes skull.

have been recovered. Of the lower jaw (Plate IV), the right side is well preserved, with the first and second molar teeth in place and the canine tooth separate (fig. 9, p. 22).

The brain-case is remarkable for its unusually great thickness (fig. 2) and for the fineness of the spongy bone (diploe) between the thin outer and inner layers (tables). It must have been highly resistant to blows. The thickness of the roof is from 10 to 12 mm., whereas the average thickness of modern European skulls varies between 5 and 6 mm., while that of modern Australian skulls and of the fossil Mousterian skulls is only from 6 to 8 mm.

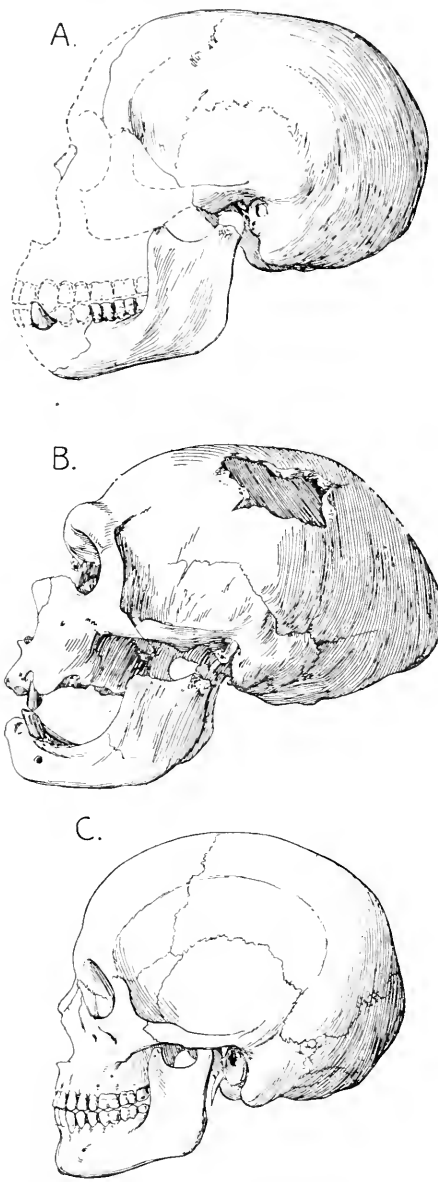


FIG. 3.—Left side view of the Piltdown skull (A), the Neanderthal (Mousterian) skull from La-Chapelle-aux-Saints (B), and a modern Human skull (C), the second after M. Boule; one-quarter nat. size. The lower jaw of the La Chapelle skull is altered in shape by the loss of the teeth and disease.

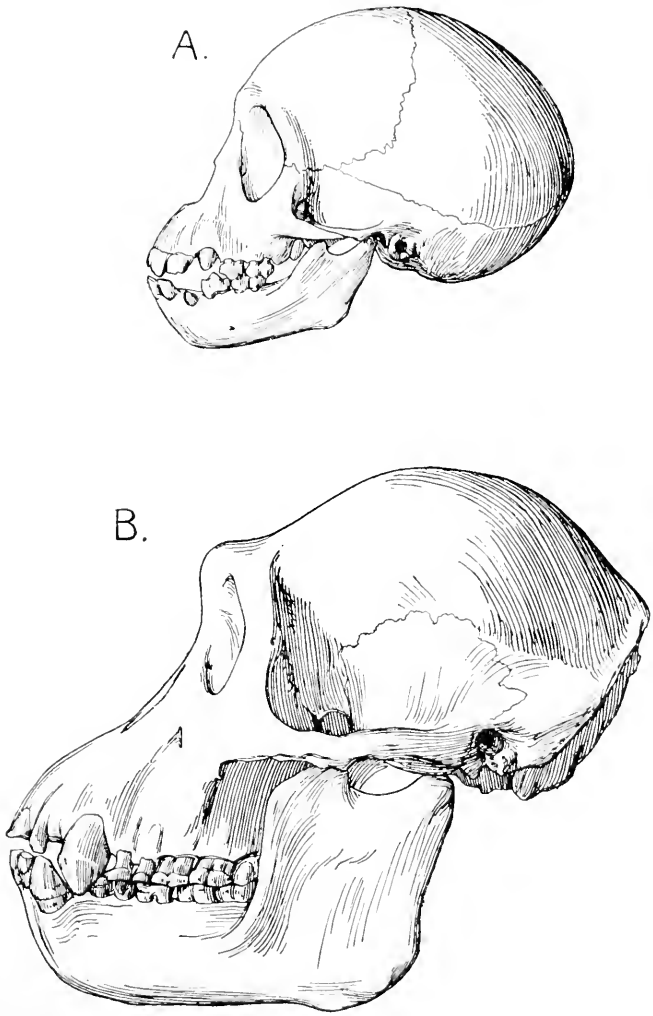


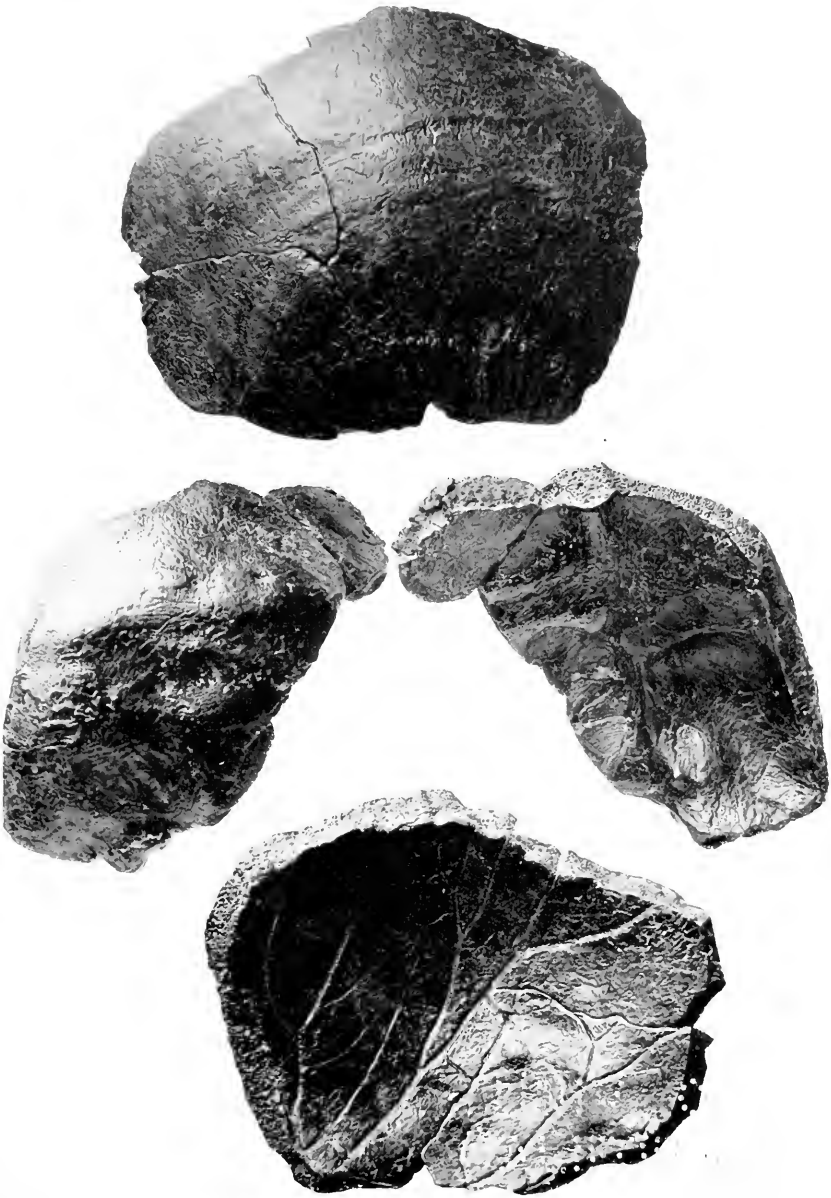
FIG. 1. Left side view of the skull and lower jaw of the young (A) and adult (B) Chimpanzee; nearly one-half nat. size. The young skull is shaped somewhat like that of Piltdown man, with no bony brow-ridges; the adult skull resembles that of the later Neanderthal (Mousterian) man in the shape of the forehead and the massive bony brow-ridges.

Among modern men the Piltdown thickness is rarely equalled, except in cases of disease.

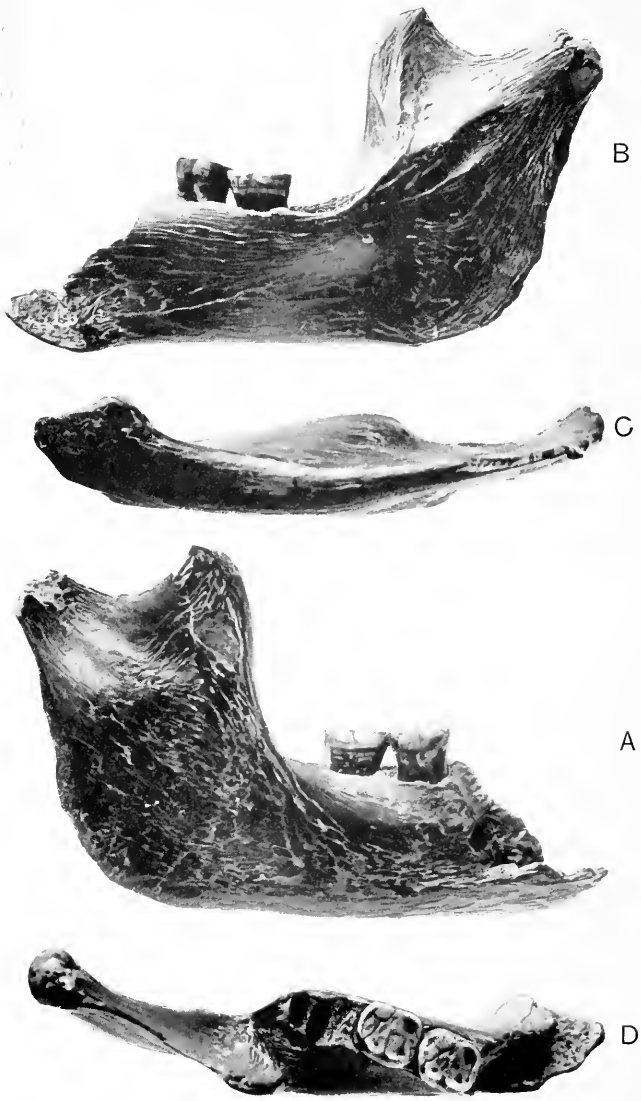
The exact shape and proportions of the skull are at first sight difficult to determine, because the middle line has to be found by inference; but the impressions of the blood-vessels (meningeals) and part of the median longitudinal blood-sinus on the inner surface are unusually distinct (Plate I), while slight indications of the median longitudinal (sagittal) suture between the two parietal bones are seen both in front and behind, so that the middle line is determinable within three or four millimetres. In any case the skull must have been very broad in proportion to its length (brachycephalic), the crown is low and flattened compared with that in an ordinary modern man (fig. 2), and the back of the skull is remarkably low and broad, indicating a very thick neck.

Enough of the forehead is preserved to show that it is as steep as usual in modern man, without any overhanging or prominent bony brow; but the bounding ridge on each side, which marks the front limit of the space for the temporal muscle, is peculiar in approaching nearest its fellow, not just above the eye, but higher up where it crosses the suture (coronal) between the frontal and parietal bones (Plate I). This peculiarity, the relative breadth of the back of the head, and perhaps other small features, are suggestive of the apes rather than of typical man; but on the whole the skull is absolutely human. The temporal bone, with its articular surface for the lower jaw, is especially human in every detail (Plate II), its only noteworthy feature being the inclination of the inner part enclosing the organ of hearing (petrosal), which agrees with that of the later Mousterian skulls in causing the outer face of the temporal lobe of the brain to slope downwards and inwards, instead of being nearly vertical. The small gently arched nasal bones resemble those of low races of men, but the face must have been unusually large.

The cast of the brain-cavity taken from the reconstructed skull is of remarkably unsymmetrical shape, the left cerebral hemisphere being much the larger, with a prominence behind. This arrangement probably implies right-handedness. So far as they can be distinguished, the convolutions of the brain are simpler than those of modern man, and there are certain parts which remain scarcely more developed than they are in a modern child. In fact, according to Prof. Elliot Smith, the whole structure must be regarded as the most primitive and most ape-like human



Photographs of imperfect right parietal (A, B) and occipital (C, D) bones of skull of Piltdown man, outer and inner views; inner view of occipital (D) showing impression of very unsymmetrical brain; two-thirds nat. size.



Photographs of imperfect right half of lower jaw of Piltdown man, with first two molar teeth in place, outer (A), inner (B), lower (C), and upper (D) views; two-thirds nat. size.

brain hitherto discovered. It is, however, essentially human, and its bulk, probably nearly 1,300 cubic centimetres, is equal to that of the smaller human brains at the present day. In modern Europeans the brain capacity averages 1,480 c.c., while in Australians it rarely exceeds 1,250 c.c.

While the Piltdown skull is thus completely human, the half of the lower jaw, so far as preserved (Plate IV), is almost precisely that of an ape. The condyle for articulation with the skull is unfortunately missing, and the upper part of the front end of the jaw is also broken away; but the rest of the bone is in good condition. The hinder or ascending portion is wide in proportion to its depth, and the notch in its upper border is rather shallow, as in some low types of man (figs. 5, 6). Its anterior border is so much widened for the insertion of an unusually powerful temporal (or biting) muscle, that it ends inwardly in a sharp edge, and the bone is strengthened by a distinct ridge on the inner face running obliquely upwards to the articular condyle (fig. 6B). This arrangement is specially characteristic of the apes and rare in man. The slight groove (mylohyoid groove, *m.g.*) which almost invariably starts from the edge of the perforation (dental foramen) on the inner face in man (fig. 6 C, D) is represented in the fossil by a still slighter groove well below the foramen (fig. 6B), exactly as in all chimpanzees (fig. 6A) and orang-utans. The inner face of the anterior or horizontal portion of the bone is only gently convex, as in the apes, without any trace of the ridge (*m.r.*) which is almost always conspicuous where the floor of the mouth (mylohyoid muscle) arises in man. Finally, and still more remarkably, as the half of the jaw curves round in front to the middle line (symphysis), its lower border (fig. 7) does not remain simply rounded, as in all known men, but exhibits an increasingly wider flattening, which begins beneath the second molar, slopes upwards and outwards, and ends in front in a strongly retreating chin. This chin is therefore essentially similar to that of all the existing apes, with a nearly horizontal plate or flange of bone extending inwards and backwards from its lower border. The muscles which work the bones at the base of the tongue and arise in man on little bony prominences inside the chin, would here originate in a pit, as in all the apes and monkeys. In fact, all the peculiarities so far noted are those of a jaw which is commonly regarded as incapable of producing articulate speech; but as the whole jaw in Piltdown man must have been much wider and more capacious than that of any ape, there seems to

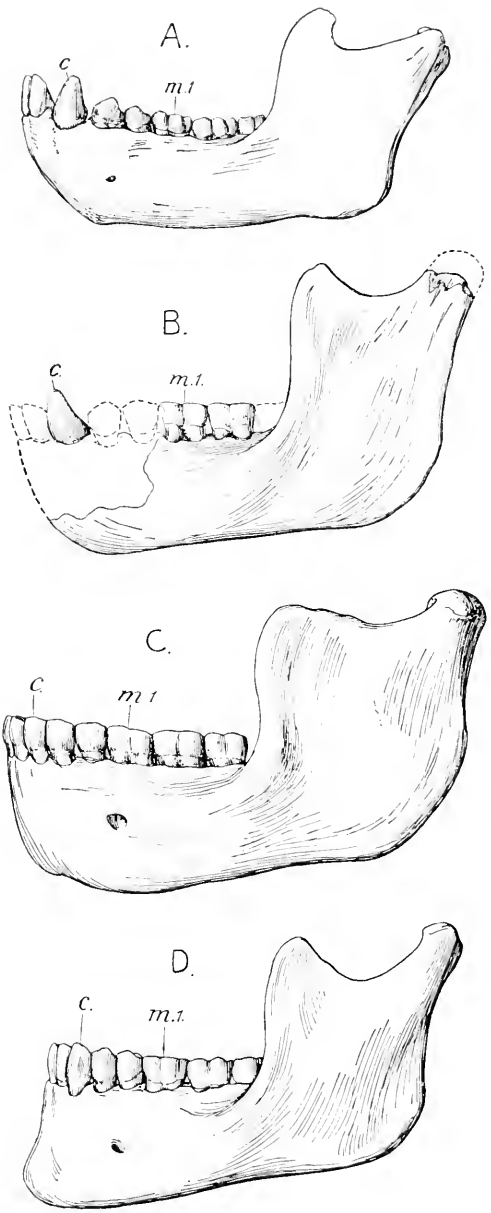


FIG. 5.—Left outer side view of lower jaw of Piltdown man (B) compared with that of Chimpanzee (A), Heidelberg man (C), and modern man (D); one-half nat. size. *c.* = canine tooth; *m.*1 = first molar tooth.

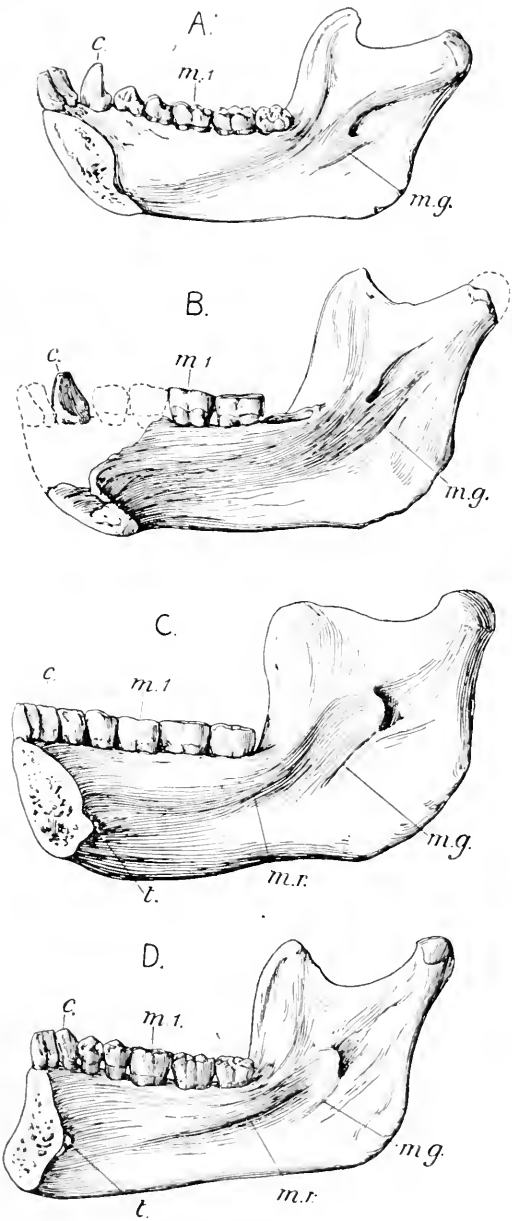


FIG. 6.—Inner side view of lower jaw of Piltdown man (B) compared with that of Chimpanzee (A), Heidelberg man (C), and modern man (D); one-half nat. size. *c.* = canine tooth; *m.*1 = first molar tooth; *t.* = genial tubercles; *m.g.* = mylohyoid groove; *m.r.* = mylohyoid ridge.

be no reason why he should not have been capable of at least simple articulation.

The two molar teeth preserved in the lower jaw are essentially human, and have been worn flat in human fashion by the masti-

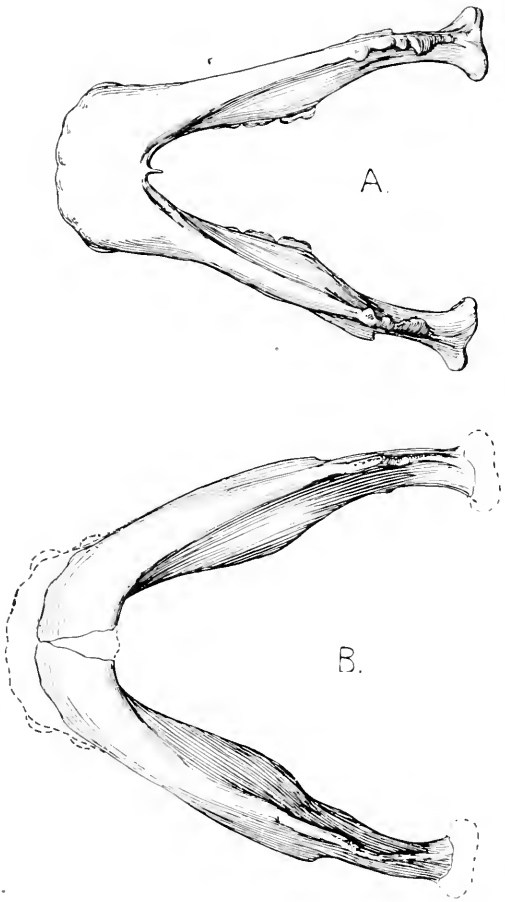


FIG. 7.—Continuation and explanation opposite.

cation of coarse or gritty food (Plate IV and fig. 8B, p. 20). They are merely rather large and unusually long and narrow; and the socket for the third or hindmost molar shows that it must have been scarcely inferior in size They are thus the kind of teeth

commonly associated with the lowest races of men. When, however, the missing part of the tooth-bearing border in front of the

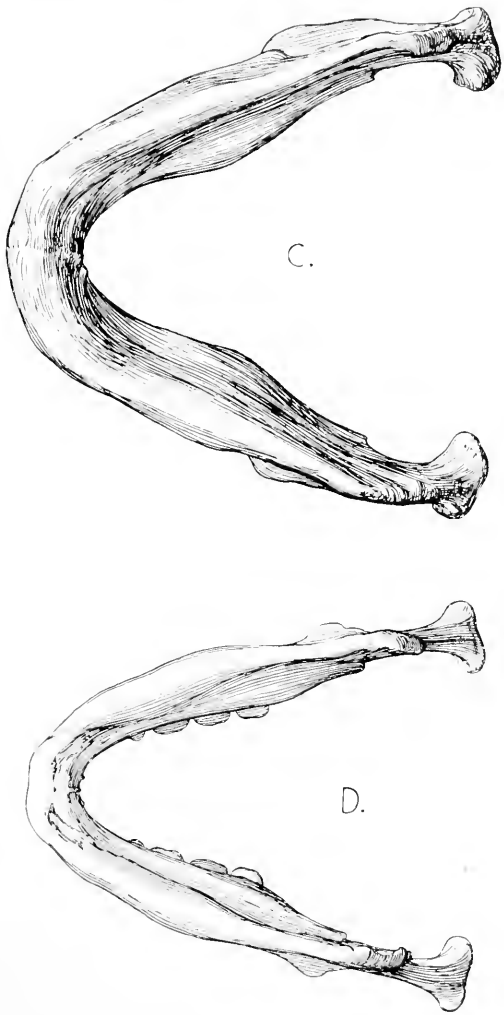


FIG. 7.—Lower view of lower jaw of Piltdown man (B) compared with that of Chimpanzee (A), Heidelberg man (C), and modern man (D); one-half nat. size.

molars is restored, it is found to be too long to be filled by any known human teeth (compare fig. 11). The first studies of the

specimen thus led to the conclusion that the canine tooth must have been larger than in man, and separated from the premolar by a slight gap, which would allow it to interlock with the large upper canine in the true ape-fashion. Fortunately, some months

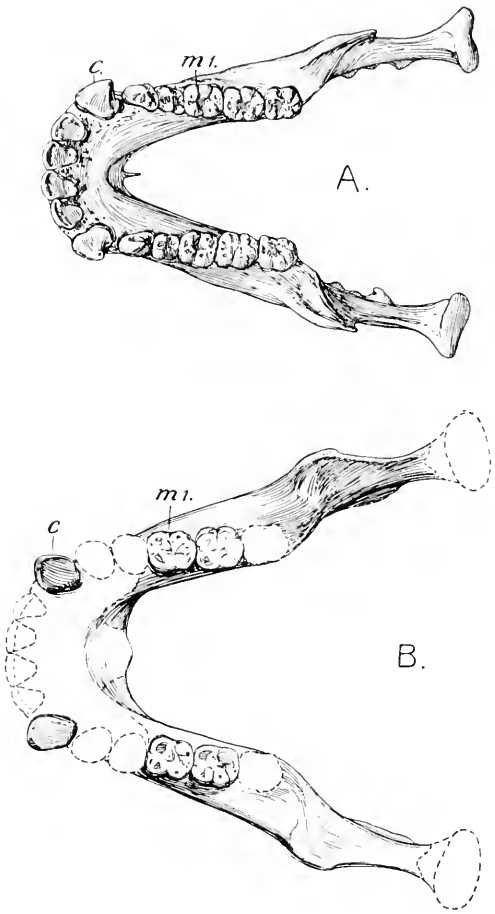


Fig. 8.—Continuation and explanation opposite.

afterwards, the actual tooth (fig. 9B) was picked up by Father P. Teilhard, in the presence of Mr. Dawson and Dr. Smith Woodward, and entirely confirmed this conclusion. It was lying in the gravel close to the spot whence the lower jaw itself had been disinterred.

Like the molar teeth this canine is also much worn by mastication, and the surface of wear could only have been produced by an opposing tooth which interlocked so far as the level of the gum.

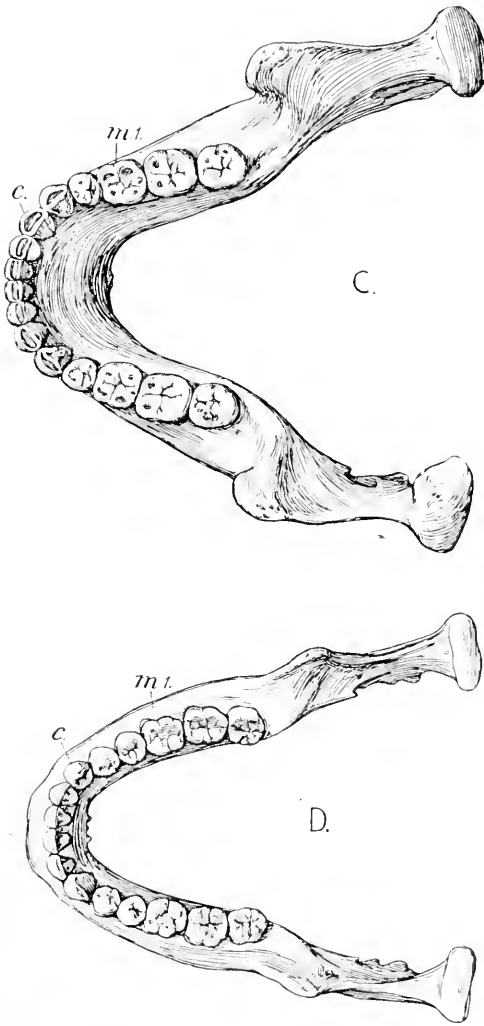


FIG. 8.—Upper view of lower jaw of Piltdown man (B), compared with that of Chimpanzee (A), Heidelberg man (C), and modern man (D); one-half nat. size. *c.* = canine tooth; *m.*1 = first molar tooth.

The tooth, however, is of special interest because its crown differs a little in shape from the canine of any known ape, and agrees

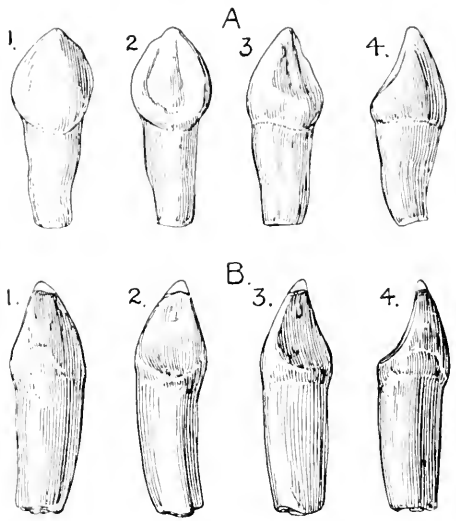


FIG. 9.- Right lower canine tooth of Piltdown man (B), shown in outer (1), inner (2), anterior (3), and posterior views (4), compared with the temporary (milk-) canine tooth of modern man (A) in corresponding views; the Piltdown tooth nat. size, the modern human tooth somewhat enlarged, and the shape of the crown of the former slightly altered by wear during life.

more closely with the temporary (or milk-) canine of modern man (fig. 9A). Even in man this temporary tooth is often relatively

FIG. 10.—Outer view of right lower temporary (or milk-) canine (*c*) and incisor teeth of modern man, showing that if the base of the crown of the canine were raised to the level of the others, the tooth would project above the others; nat. size.

large, and, if it rose to the same level in the gum as the adjacent teeth, would project above them (fig. 10). Hence, Piltdown man

is an ancestor in which the permanent front teeth of the lower jaw were approximately of the same shape as the temporary front teeth of modern man. In all mammals which are sufficiently well known, the permanent teeth of the ancestral race agree more closely in pattern with the milk-teeth than with the permanent teeth of its altered descendants.

Piltdown man is therefore a "man of the dawn," *Eoanthropus*, and is named *dawsoni* in honour of his discoverer. He shows that man acquired his characteristic brain and skull before the ultimate reduction and refinement of his face; that he did not completely lose his canine teeth as weapons until the development of the brain enabled him to substitute craft and implements for mere brute force in the struggle for life.

The actual specimens of the skull and lower jaw are kept in the study-collection of the Museum, but exact copies of all the pieces are exhibited with explanatory labels and other specimens for comparison in Table-case 1.

HEIDELBERG MAN (*Homo heidelbergensis*).

Man with typically human teeth also lived in Europe so early as the beginning of the Pleistocene period, but he is known only by a single lower jaw found in 1907 in a sand-pit at Mauer, near Heidelberg. This specimen occurred in a river-deposit associated with numerous bones and teeth of horse, rhinoceros (*Rhinoceros etruscus*), elephant (*Elephas antiquus*), bear (*Ursus deningeri*), and other mammals which can scarcely have survived later than the early part of the Pleistocene period.

As shown by the plaster cast presented by the discoverer, the late Dr. Otto Schoetensack, the Heidelberg lower jaw is large and remarkably stout, with every essential feature of a modern human jaw except the bony prominence of the chin (figs. 5c, 6c, 7c, 8c). The absence of this prominence gives the chin a retreating shape approaching that of the ape; but the large shallow pit, always conspicuous on the inner face of the bony chin in the ape, is here nearly filled with a deposit of bone which rises into the characteristically human "genial tubercles" (*t.*) for the origin of the small muscles which help to work the tongue. The great width of the hinder ascending part of the jaw and the shallowness of the notch in its upper border are also ape-like peculiarities, though already known in some low races of both existing and fossil men.

Compared with the size and massiveness of the bone, the teeth are small; but they agree well in size and shape with those of some of the lower races of men, and they are only noteworthy for the rather arched form of the front teeth (incisors). The canines are neither unusually large nor prominent.

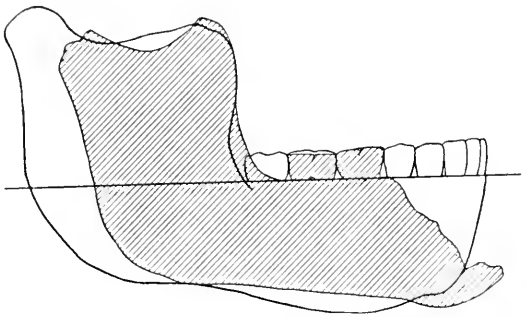


FIG. 11.—The imperfect right half of lower jaw of Piltdown man (shaded) superposed on that of Heidelberg man (outline), to show the greater forward extension of the chin-region in the former; one-half nat. size.

Heidelberg man, therefore, still retained a more ape-like bony chin than any existing man, while his face must have been remarkably large; but he was merely a distinct species of the genus *Homo*, and his skull cannot have differed much from that of modern man.

NEANDERTHAL or MOUSTERIAN MAN
(*Homo primigenius*).

Somewhat later in the Pleistocene period there appeared in Europe another distinct race of men, of which several fragments have been found, and the nearly complete skeleton is now known. The first specimen was discovered in 1857 in a cavern in the Neanderthal, near Düsseldorf, Germany: hence the race is often described as that of Neanderthal man. When associated stone implements occur, they always resemble those met with in the cavern of Le Moustier, Dordogne, France: hence a second name in frequent use is that of Mousterian man. In scientific nomenclature he is variously termed *Homo primigenius*, *Homo neanderthalensis*, or *Homo mousteriensis*. The stone implements are simply flaked on one face, but well shaped by elaborate chipping

on the other face. The contemporary mammals include the mammoth (*Elephas primigenius*), bison (*Bison priscus*), reindeer (*Rangifer tarandus*), woolly rhinoceros (*Rhinoceros antiquitatis*), cave hyæna (*Hyæna spelæa*), cave lion (*Felis spelæa*), and many others. The climate of the time was therefore probably cold.

Of the skeleton found in the Neanderthal cavern only the roof of the skull and a few ribs and limb-bones were preserved, now in one of the museums at Bonn, Germany. As shown by a plaster cast in Table-case 1, the roof of the skull differs from that of any ordinary modern human skull in having enormous bony brow-ridges, which produce a retreating forehead similar to that in the existing apes. The size of the brain-case, however, and the impression of the brain itself, so far as shown, are distinctly human. The bone is rather thick.

The greater part of a smaller skull of the same race was discovered in 1848 in a cavern at Gibraltar, and is now in the Museum of the Royal College of Surgeons. As shown by a plaster cast in Table-case 1, the characteristic brow-ridges overhang a relatively large face.

Until 1886 the geological age of the Neanderthal and Gibraltar human remains was uncertain, because no associated fossils had been obtained; but in that year two more skeletons of the Neanderthal race were described by Professors Fraipont and Lohest from earth beneath undisturbed stalagmite at the mouth of a cavern in Spy, Namur (Belgium), where both Mousterian implements and the characteristic mammalian bones of the same period occurred in abundance. The bones of mammoth and rhinoceros were found not only with the human skeletons under the stalagmite but also in the earth above this sealing-up layer; so there could be no doubt that the men were contemporary with the extinct animals mentioned—that the skeletons could not have been introduced into the old deposit by a burial of later date. As shown by the plaster casts in Table-case 1, the skulls are less incomplete than the original Neanderthal fragment, and both exhibit the characteristic bony brow-ridges with the retreating forehead. The jaws and teeth, so far as preserved, are typically human, and the only striking feature is the absence of a prominent bony chin.

In 1908 another skeleton was found in the small cavern of La-Chapelle-aux-Saints in the Corrèze, south-west of France, and this was so well preserved that Professor Marcellin Boule's description of the specimen refers to almost every part and

justifies the restored sketch given in fig. 12A. The body had been buried in a contracted posture in a hollow of the rock-floor, and the overlying earth contained numerous broken bones of the woolly rhinoceros, bison, reindeer, and other animals, besides flint implements of the characteristic Mousterian shape. The leg of a bison close to the human skeleton must have been buried with the flesh on it, and may have been intended as food for the departed spirit. As shown by the plaster cast in Table-case 1,

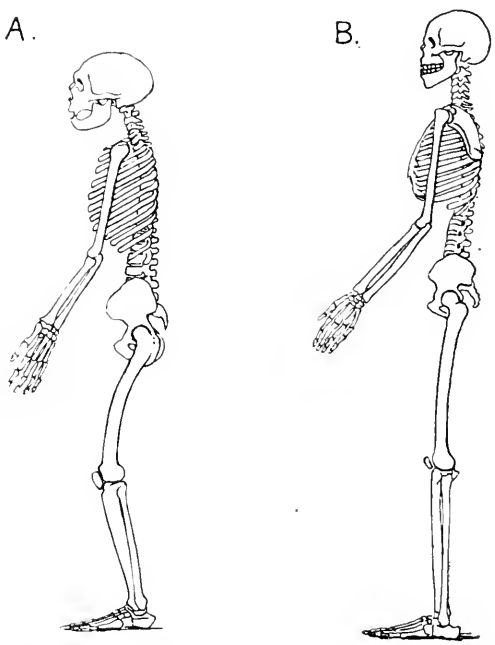


FIG. 12.—Diagrammatic restoration of skeleton of Neanderthal man (A) compared with skeleton of existing Australian man (B). (After M. Boule.)

the skull, with its massive brow-ridges, is essentially complete (fig. 3B, p. 12). The bone of the brain-case is moderately thick, the parietal thickness being from 6 to 8 mm., and the skull is shaped behind like a depressed chignon. The size of the brain-cavity (about 1,626 cubic centimetres) is greater than that of the average modern European, but the impression of the brain suggests that it may have been inferior in quality. As the left cerebral hemisphere is the larger, the man was probably right-

handed. The face is relatively larger than usual in modern man, and the chin lacks any bony prominence. The individual would be only 50 to 55 years old, but most of the lower teeth were lost by disease. The skeleton is of rather short stature, and the head is relatively the largest yet known in any race of man. The backbone is about 2 inches shorter and somewhat stouter than usual in modern man. The arm is rather long. As in the Spy skeletons (see plaster cast in Table-case 1), the thigh-bone is remarkably curved, almost as in the apes; but the whole limb appears to indicate an habitually upright gait. Small extensions of the joint-surfaces on some of the bones seem to imply that rest was taken in a squatting posture.

Neanderthal man, therefore, does not exhibit any characters which cannot be paralleled occasionally among modern men; but he is distinctly inferior in having all these lowly characters combined in a single individual. He has been supposed to bear some close relationship to the blacks surviving in the Australian region, but the skeleton from La-Chapelle-aux-Saints and later discoveries from other French caves show that there is no great resemblance between the two races (fig. 12).

MODERN MAN (*Homo sapiens*).

All the human remains of later date than the Neanderthal race are so closely similar to those of modern man, that there is no reason for excluding them from the species *Homo sapiens*. Some of them, such as the skull from the cavern of Engis, near Liège, Belgium (of which a plaster cast is placed in Table-case 1), have been discovered in undoubted association with bones of the mammoth and woolly rhinoceros and other animals which disappeared at the end of the Pleistocene period. They have, indeed, been found with all the three kinds of late Pleistocene implements, which are usually described as Aurignacian, Solutrean, and Magdalenian. The skeletons, however, are in no respects inferior to those even of civilised man, and the chief interest of their study lies in an attempt to discover to which existing races they bear the most intimate relationship.

Owing to the rarity of good specimens this study has hitherto made very little satisfactory progress. It has also been rendered more difficult by the frequent uncertainty as to whether a human skeleton found in a particular geological stratum is really of the

same age as the deposit or has been buried by man at a later date. Such doubt exists, for example, in reference to the Galley Hill skeleton (Table-case 1), which is quite of a modern type, but was found in one of the oldest Pleistocene gravels in the Thames valley. Finally, it may be added that near the mouth of a river, sediment often accumulates so rapidly that burial at a considerable depth does not necessarily imply great age. The skeleton found at a depth of 30 feet in Thames mud during the excavation of Tilbury Docks (Table-case 1) is, indeed, probably not older than the Neolithic period, and may be of a still later date. The difficulty of the subject is therefore great, and the chief need for the future is more material with the exact circumstances of each discovery carefully recorded.

All the human remains hitherto found fossil in America also seem to belong to modern man. The skeleton from an indurated beach in the Island of Guadaloupe, West Indies, exhibited in Pier-case 2, probably does not date back further than the historic period in that region.

CONCLUSION.

The general conclusion is that man, having a skeleton essentially identical with the existing one, has lived in western Europe for a long period during great changes of climate, much alteration in geographical contour, and the dying out of numerous wild quadrupeds. He was here long before the British Isles were separated by sea from the mainland of Europe. His immediate predecessor was a form of man (the Neanderthal or Mousterian) which more nearly approached the apes in the retreating forehead, the prominence of the bony brow, and the large size of the face. The skeleton of his trunk also exhibited a combination of more ape-like features than are known in any single human skeleton of later date. Still earlier Heidelberg man, though with typically human teeth, had a much more retreating bony chin suggestive of closer relationship to the apes. Finally, Piltdown man, which is at least as old as the Heidelberg race, and probably older, had both lower jaw and front teeth as nearly on the ape-pattern as was compatible with their working on a human skull of normal width. His skull, however, though with a very large face, and in some respects the most ape-like known, appears at first sight to be contrary to expectation in the steepness of its forehead and the

absence of the modern ape's characteristic brow-ridges. But it must be remembered that, in accordance with a well-known law, the skull in the adult ancestral apes of Miocene times (still to be discovered) probably resembled that of the very young existing ape (fig. 4A, p. 13), not that of a full-grown individual (fig. 4B). Just as the bony brow-ridges are acquired during the life of each individual existing ape, so the race of apes began without them, and only gradually acquired them as an adult character through successive generations. The Piltdown skull, therefore, probably resembles the skull of the truly ancestral apes much more closely than does the later Neanderthal skull, in which the bony brow-ridges may be a mark of peculiar degeneration. The *Pithecanthropus* from Java may be another degenerate.

Hence, although the facts are still very scanty, it is evident that the further human remains are traced back in geological time, the more marks they retain of an ape-like ancestry. They suggest a gradual approach to a primitive forest-animal with an overgrown brain, which was destined to begin a fundamentally new departure in organic evolution.

LITERATURE.

References to the earlier literature will be found in the following recent books and papers:—

W. J. Sollas, "Ancient Hunters and their Modern Representatives." London, 1911 (second edition, 1914).

R. Munro, "Palæolithic Man and Terramara Settlements in Europe." Edinburgh, 1912.

R. Munro, "Prehistoric Britain." Home University Library, London, 1914.

W. L. H. Duckworth, "Prehistoric Man." Cambridge Manuals, 1912.

J. Geikie, "The Antiquity of Man in Europe." Edinburgh, 1914.

G. Elliot Smith, Address to Section H, Anthropology, British Association, Dundee, 1912. Report of the Eighty-second Meeting of the British Association, 1913.

E. Dubois, "*Pithecanthropus erectus:* eine Menschenaehnliche Uebergangsform aus Java." Batavia, 1894.

C. Dawson and A. S. Woodward, "On the Discovery of a Palæolithic Skull and Mandible in a Flint-bearing Gravel overlying the Wealden (Hastings Beds) at Piltdown, Fletching (Sussex)." Quarterly Journal of the Geological Society, vol. lxix (1913).

C. Dawson and A. S. Woodward, "Supplementary Note on the Discovery of a Palæolithic Human Skull and Mandible at Piltdown (Sussex)." Quarterly Journal of the Geological Society, vol. lxx (1914).

O. Schoetensack, "Der Unterkiefer des *Homo heidelbergensis* aus den Sanden von Mauer bei Heidelberg." Leipzig, 1908.

M. Boule, "L'Homme Fossile de La-Chapelle-aux-Saints." Annales de Paléontologie, vols. vi–viii (1911–1913).

See also "A Guide to the Antiquities of the Stone Age in the Department of British and Mediæval Antiquities," published by the Trustees of the British Museum.

GUIDE-BOOKS.

(*The Guide-Books can be obtained at the Museum. Postage extra.*)

General Guide to the Museum, 8vo. 3*d*. *Postage* 2*d*.
Guide to the Races of Mankind (Anthropology), 8vo. 4*d*. *Postage* 1½*d*.
——————— Galleries of Mammals, 8vo. 9*d*. *Postage* 2½*d*.
——————— Great Game Animals, 8vo. 1*s*. *Postage* 2½*d*.
——————— Elephants (Recent and Fossil), 8vo. 6*d*. *Postage* 1½*d*.
——————— Horse Family, 8vo. 1*s*. *Postage* 2*d*.
——————— Domesticated Animals (other than Horses), 8vo. 6*d*. *Postage* 2*d*.
——————— Whales, Porpoises, and Dolphins, 8vo. 4*d*. *Postage* 1½*d*.
——————— Gallery of Birds, 4to. 2*s*. 6*d*. *Postage* 5*d*.
——————— General Series of Birds, 4to. 6*d*. *Postage* 4*d*.
——————— Nesting Series of British Birds, 4to. 4*d*. *Postage* 2*d*.
——————— Gallery of Reptilia and Amphibia, 8vo. 1*s*. *Postage* 2½*d*.
——————— Gallery of Fishes, 8vo. 1*s*. *Postage* 4*d*.
——————— British Vertebrates, 8vo. 1*s*. *Postage* 3*d*.
——————— Insect Gallery, 8vo. 1*s*. *Postage* 2½*d*.
——————— Crustacea, Arachnida, Myriopoda, etc., 8vo. 1*s*. *Postage* 3*d*.
——————— Shell and Starfish Galleries, 8vo. 6*d*. *Postage* 3*d*.
——————— Coral Gallery, 8vo. 1*s*. *Postage* 4*d*.
——————— Fossil Remains of Man, 8vo. 4*d*. *Postage* 1*d*.
——————— Fossil Mammals and Birds, 8vo. 6*d*. *Postage* 3*d*.
——————— Fossil Reptiles and Fishes, 8vo. 9*d*. *Postage* 4*d*.
——————— Fossil Invertebrate Animals, 8vo. 1*s*. *Postage* 4*d*.
——————— Mineral Gallery, 8vo. 1*d*. *Postage* 1*d*.
Student's Index to the Collection of Minerals, 8vo. 2*d*. *Postage* 1*d*.
An Introduction to the Study of Minerals, with a Guide to the Mineral Gallery, 8vo. 6*d*. *Postage* 2½*d*.
An Introduction to the Study of Rocks, 8vo. 1*s*. *Postage* 4*d*.
——————————————— Meteorites, 8vo. 1*s*. *Postage* 2½*d*.
Guide to Sowerby's Models of British Fungi, 8vo. 4*d*. *Postage* 2*d*.
——— Mushrooms, 8vo. 1*s*. *Postage* 1*d*.
——— the British Mycetozoa, 8vo. 3*d*. *Postage* 1*d*.
List of British Seed-Plants and Ferns, 8vo. 4*d*. *Postage* 1*d*.
Special Guides: No. 2. History of Plant Classification, 8vo. 4*d*. *Postage* 1*d*.
——————— No. 4. Memorials of Charles Darwin, 8vo. 6*d*. *Postage* 1½*d*.
——————— No. 5. Exhibition of Bible Animals, Plants, and Minerals, 8vo. 6*d*. *Postage* 1½*d*.
——————— No. 6. Exhibition of Specimens illustrating Modes of Flight in Animals, 8vo. 6*d*. *Postage* 1½*d*.
Handbook of Instructions for Collectors, 8vo. 1*s*. 6*d*.; or in eleven separate sections, at 3*d*. or 4*d*. each. *Postage:* Handbook, 2*d*.; sections, each 1*d*.
Economic Series: No. 1. The House-Fly as a Danger to Health, 8vo. 1*d*.

CATALOGUES, ETC. (SELECTION).

History of the Collections:—

Vol. I. Libraries; Botany; Geology; Minerals. 1904, 8vo. 15*s*.

Vol. II. Zoology. 1906, 8vo. £1 10*s*. Vol. II. Appendix. Zoology. 1912, 8vo. 5*s*.

Catalogue of the Library of the British Museum (Natural History). Vols. I.–IV. 1903–13, 4to. £1 each.

Report on the Collections of Natural History made in the Antarctic Regions during the Voyage of the 'Southern Cross.' 53 Plates. 1902, roy. 8vo. £2.

Reports on the Natural History of the 'Discovery' National Antarctic Expedition, 1901–4:—

Vol. I. Geology. 10 Plates, 72 Text-figures, 2 Maps. 1907, 4to. £1 10*s*.

Vol. II. Zoology (Vertebrata: Mollusca; Crustacea). 33 Plates, 146 Text-figures, 1 Map. 1907, 4to. £3.

Vol. III. Zoology (Invertebrata) and Botany (Marine Algæ: Musci). 51 Plates, 8 Text-figures, 1 Chart. 1907, 4to. £2 10*s*.

Vol. IV. Zoology (Invertebrata). 65 Plates, 1 Text-figure. 1908, 4to. £1 15*s*.

Vol. V. Zoology and Botany. 28 Plates, 19 Text-figures. 1910, 4to. £1 10*s*.

Vol. VI. Zoology and Botany. 9 Plates, 1 Text-figure. 1912, 4to. 16*s*.

British Antarctic ('Terra Nova') Expedition, 1910. Natural History Report:—

Zoology. Vol. I.—No. 1. Fishes. 8 Text-figures, 13 Plates. 1914, 4to. 10*s*. 6*d*.

Zoology. Vol. II.—No. 1. List of Collecting Stations. 4 Maps. 1914, 4to. 1*s*. 6*d*.

Geology. Vol. I.—No. 1. Antarctic Fossil Plants. 6 Text-figures, 3 Maps, 8 Plates. 1914, 4to. 6*s*.

Catalogue of Chiroptera (Bats). Vol. I. Megachiroptera. 80 Text-figures. 1912, 8vo. £2 10*s*.

Monograph of the Okapi. Atlas of 48 Plates, with explanatory text. 1910, 4to. £1 5*s*.

Catalogue of Mammals of Western Europe. 213 Text-figures. 1912, 8vo. £1 6*s*.

Catalogue of Ungulate Mammals. Vols. I.–III. Text illust. 1913–14, 8vo. 7*s*. 6*d*. each.

Catalogue of Marsupialia and Monotremata. Plates. 1888, 8vo. £1 8*s*.

——————— Birds. Vols. X.–XXVII. Woodcuts and Coloured Plates. 1885–98, 8vo. 20*s*. to 36*s*. a volume. (*Vols I.–IX. out of print.*)

Hand List of the Genera and Species of Birds. Vol. V. 1909, 8vo. £1. (*Vols I.–IV. out of print.*) Index to Vols. I.–V. 1912, 8vo. 10*s*.

Catalogue of Birds' Eggs. Vols. I.–V. Coloured Plates. 1901–12, 8vo. £1 5*s*. to £2 7*s*. 6*d*. a volume.

Catalogue of Lizards. 2nd Edition. Vols. II., III. Plates. 1885–87, 8vo. Vol. II., 20*s*.; Vol. III., 26*s*. (*Vol. I. out of print.*)

Catalogue of Snakes. Vols. I.–III. Woodcuts and Plates. 1893–96, 8vo. 17*s*. 6*d*. to £1 6*s*. each.

Catalogue of Fishes. 2nd Edition. Vol. I. Woodcuts and 15 Plates. 1895, 8vo. 15*s*.

Catalogue of Freshwater Fishes of Africa. Imp. 8vo. Vol. I. 270 Text-figures. 1909. £1 12*s*. 6*d*. Vol. II. 382 Text-figures. 1911. £2 5*s*.

Catalogue of Madreporarian Corals. Vols. I.–VI. Plates. 1893–1906, 4to. 18*s*. to 35*s*. a volume.

CATALOGUES, ETC. (SELECTION)—*continued.*

Catalogue of Fossil Mammalia. Parts I.–V. Text illust. 1885–87, 8vo. 4*s.* to 6*s.* a part.

Catalogue of Fossil Birds. 75 Woodcuts. 1891, 8vo. 10*s.* 6*d.*

——————— Reptilia and Amphibia. Parts I.–IV. Text illust. 1888–90, 8vo. 7*s.* 6*d.* each.

Catalogue of Marine Reptiles of the Oxford Clay, based on the Leeds Collection. Part I. 94 Text-figures, 11 Plates. 1910, 4to. £1 5*s.* Part II. 73 Text-figures, 14 Plates. 1913, 4to. £1 5*s.*

Catalogue of Fossil Fishes. Parts I.–IV. Plates and Woodcuts. 1889–1901, 8vo. 21*s.* each.

Catalogue of the Tertiary Vertebrata of the Fayûm, Egypt. 26 Plates and 98 Text-figures. 1906, 4to. £1 15*s.*

Systematic List of the Edwards Collection of British Oligocene and Eocene Mollusca. 1891, 8vo. 6*s.*

Catalogue of Tertiary Mollusca. Part I. The Australasian Tertiary Mollusca. 8 Plates. 1897, 8vo. 10*s.*

Catalogue of Fossil Cephalopoda. Parts I.–III. Text illust. 1888–97, 8vo. 10*s.* 6*d.* to 15*s.* a part.

List of Types and Figured Specimens of Fossil Cephalopoda. 1898, 8vo. 2*s.* 6*d.*

Catalogue of British Fossil Crustacea. 1877, 8vo. 5*s.*

——————— Jurassic Bryozoa. 22 Woodcuts and 11 Plates. 1896, 8vo. 10*s.*

——————— Cretaceous Bryozoa. Vol. I. 64 Woodcuts and 17 Plates. 1899, 8vo. 16*s.* Vol. II. 75 Woodcuts and 9 Plates. 1909, 8vo. 13*s.*

Catalogue of Blastoidea. 20 Plates. 1886, 4to. 25*s.*

The Genera and Species of Blastoidea, with a List of the Specimens in the Museum. 1899, 8vo. 3*s.*

Catalogue of Palæozoic Plants. 1886, 8vo. 5*s.*

——————— Mesozoic Plants. Parts I.–V. Text illust. 1894–1913, 8vo. 10*s.* to 20*s.* a part.

Catalogue of Fossil Plants of the Glossopteris Flora. 51 Text-figures and 8 Plates. 1905, 8vo. 12*s.* 6*d.*

The above-mentioned Catalogues may be purchased of Messrs. LONGMANS & Co., 39, *Paternoster Row, London, W.*; Mr. QUARITCH, 11, *Grafton Street, New Bond Street, London, W.*; Messrs. DULAU & Co., LTD., 37, *Soho Square, London, W.*; and the MIDLAND EDUCATIONAL Co., LTD., *Corporation Street, Birmingham*; or at the NATURAL HISTORY MUSEUM, *Cromwell Road, London, S.W.* A more detailed list may be obtained on application to the DIRECTOR of the Museum.

The Guide-Books can be purchased of Mr. B. QUARITCH, Messrs. DULAU & Co., and the MIDLAND EDUCATIONAL Co. (as above); Messrs. SHERRATT & HUGHES, 34, *Cross Street, Manchester*; and the GRANT EDUCATIONAL Co., LTD., 91 and 93, *Union Street, Glasgow.*

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS, LIMITED,
DUKE STREET, STAMFORD STREET, S.E., AND GREAT WINDMILL STREET, W

UM

SION.

ee daily—

A.M., in

P.M.

0 ,,

,,

0 ,,

,,

g of May

hiddle of

P.M.

30 ,,

,,

30 ,,

,,

,,

30 ,,

,,

November and December ,, 2 ,, 4 ,,

The Museum is closed on Good Friday and Christmas Day.

By Order of the Trustees,

L. FLETCHER,

Director.

LONDON: PRINTED BY WM. CLOWES AND SONS, LTD., DUKE ST., STAMFORD ST., S.E., AND GT. WINDMILL ST., W.